2.0 INVENTORY

2.1 INTRODUCTION

Multiple sources of information were collected and analyzed to provide baseline data for the project. This chapter briefly summarizes data sources and their relevance to this study. These sources consisted of maps and plans, previous reports and studies, ordinances and standards, and other regulatory information.

2.2 MAPS AND PLANS

2.2.1 GIS Maps

Hamilton County has a comprehensive Geographic Information System (GIS) that was used extensively on the project. Data from the GIS is available to the public at the County's web page http://www.co.hamilton.in.us/gis. Figure 2-1 is an excerpt from the Hamilton County GIS.

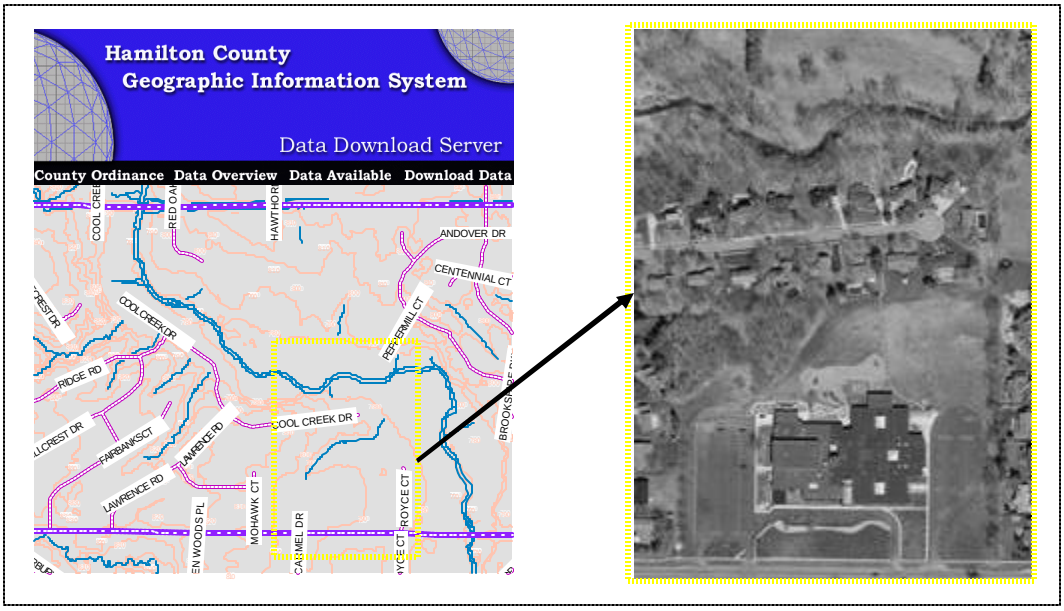

Figure 2-1
Hamilton County GIS Excerpt

The GIS contains several layers of information including the transportation system (highways, primary roads, minor roads, railroads); drainage system (drainage structures, regulated drains, streams, ponds); planimetric features (building outlines, fences, walls); topography (2' and 10' contour intervals); soils types; and political and survey boundaries. High resolution aerial photography is also available in the GIS. The GIS was updated in the fall of 2002 and was incorporated into this study.

The GIS was used to delineate watersheds and subbasins, identify land use for hydrologic modeling, analyze drainage features, identify the extent of the riparian corridor and stream buffers, and provide base mapping for figures and exhibits in this report.

2.2.2 USGS Quadrangle Maps

USGS maps (1" = 2000') were used to complement and verify the GIS topographic maps in performing watershed and subbasin delineation. Four quadrangle maps provide coverage of the entire Cool Creek watershed:

- Carmel, 1988 (5' contour interval)
- Westfield, 1992 (10' contour interval)
- Noblesville, 1992 (10' contour interval)
- Fishers, 1998 (5' contour interval)

2.2.3 National Wetland Inventory Maps

The National Wetland Inventory Maps are provided by the U. S. Department of Interior, Fish and Wildlife Service. The maps, last updated in 1989 and 1990, are provided on copies of the above mentioned USGS maps (see Figure 2-2 for an excerpt of the map along the lower reach of Cool Creek before it discharges into the White River). These maps provide the general location and extent of wetlands. Detailed delineation or assessment of the quality of wetlands in the watershed was beyond the scope of this project; however, they were included on the stream inventory maps (Chapter 3) in order to bring attention to their presence in the watershed. Final verification of the wetland boundaries should be performed by a licensed Wetland Consultant prior to approval of site plans adjacent to these areas.

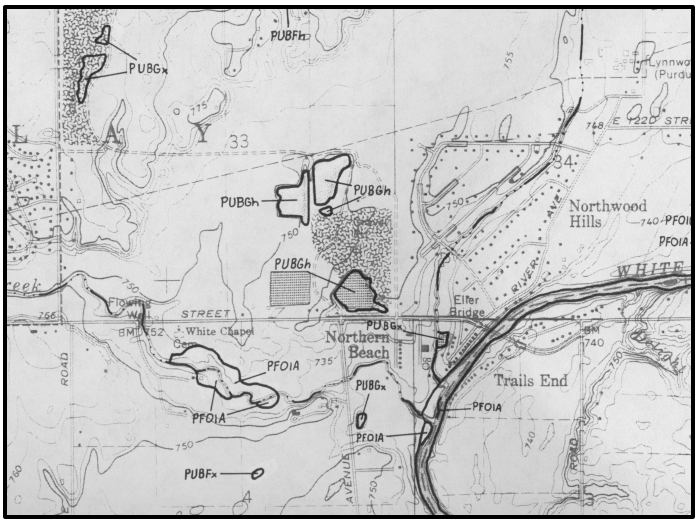

Figure 2-2
National Wetland Inventory Map Excerpt

Wetlands provide valuable functions including filtering pollutants in stormwater, providing habitat for wildlife, recharging groundwater, and providing natural flood storage. Wetlands are protected under the Federal Clean Water Act and require special permits from the U.S. Army Corps of Engineers (Section 404 permit) and IDEM (Section 401 Water Quality Certification).

Wetland regulations in Indiana (and many other states) are currently in a state of fluctuation due to a ruling in January of 2001 by the U.S. Supreme Court. In this ruling, the Court ruled against the U.S. Army Corps of Engineers and its authority to regulate certain isolated wetlands that are not adjacent to waters of the United States. Indiana has historically protected the state's waters, which include wetlands, by applying the Section 401 Water Quality Certification program in conjunction with the Section 404 U.S. Army Corps of Engineers permit program. IDEM is currently regulating isolated wetlands (those that no longer fall under Section 404 jurisdiction) through the use of NPDES permits, until a state wetland permit program is established and effective.

In order to better enforce compliance with wetland regulations and to protect their existence in future growth areas, it is recommended that wetland areas be added to the County GIS. The County will benefit from having this information readily available during the site plan review process. Furthermore, easy access to this information could be considered a Stormwater Best Management Practice (BMP) and could be used to comply with NPDES Phase II regulations.

Wetlands are scattered throughout the Cool Creek watershed though many are along the stream floodplains. The most commonly found wetland is classified as PFO1A, which stands for *Palustrine Forested Broad-Leaved Deciduous, Temporarily Flooded* wetlands. "Palustrine" comes from the Latin word "palus" or marsh. Wetlands within this category include inland marshes and swamps as well as bogs, fens, tundra and floodplains. In the Cool Creek watershed, most of the PFO1A wetlands are the floodplain type. Though all wetlands are valuable, regulatory agencies such as IDEM place a higher value on forested wetlands as compared to a small isolated wetland in a farm field. Forested wetlands provide shade to streams which in turn improves habitat for fish and wildlife.

The second most frequent type of wetland found in the watershed is Palustrine Emergent (shown as a PEMA, PEMB, PEMC, etc.). The letters following the PEM designation further describe the frequency of inundation. Emergent wetlands (sometimes known as marshes) are usually dominated by grass-like plants such as cattails, sedges or bulrush, which are rooted in bottom sediments, but "emerge" above the surface of the water.

Significant wetland areas along the Cool Creek Corridor are illustrated on the Stream Inventory Maps (Section 3.7 of Chapter 3).

2.2.4 Flood Insurance Maps

Flood Insurance Rate Maps (FIRMs) depict the regulatory floodway, the 100-year and 500-year floodplain boundary, base flood elevations, cross-section locations and other related information. During the course of this project, updated FIRM maps were being prepared for the County by others. Draft updated FIRMs were obtained from the County in the fall of 2002. The FIRMs were finalized and became effective February 19, 2003. The floodplain information in this report is based on the February 2003 updated maps. An excerpt from one of the updated FIRMs is shown on Figure 2-3.

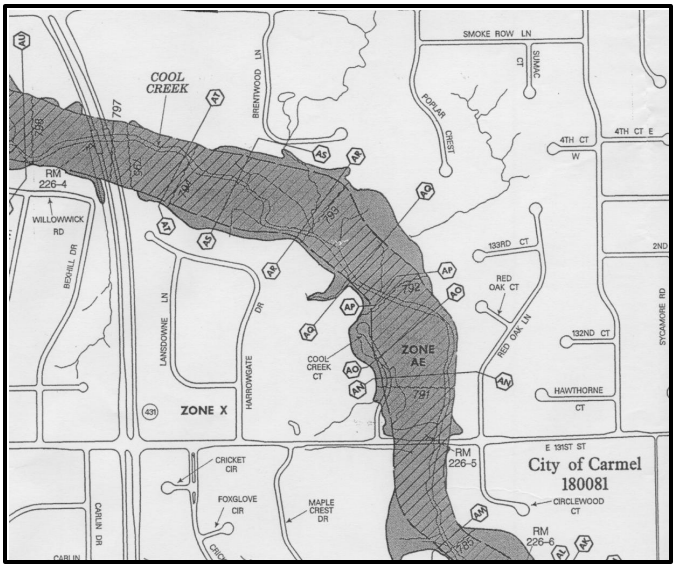

Figure 2-3
Flood Insurance Rate Map Excerpt

The flood insurance maps by themselves do not adequately illustrate the risk of flooding to buildings or other structures as they are based only on approximate topography. To better assess the flood risks and potential damages, the floodplain boundaries were re-delineated using detailed GIS-based topography with planimetric features shown. These maps are discussed Section 3.7 of Chapter 3.0.

The *floodway* is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment in order that the 100-year flood may be conveyed without substantial increases (0.1 feet or less in Indiana) in flood heights. The Indiana Department of Natural Resources (IDNR) regulates construction in the floodway. Local jurisdictions (Carmel, Westfield, and Hamilton County) regulate the portion of the floodplain outside of the floodway, referred to as the floodway *fringe*. The County has regulations prohibiting fill in the portion of the floodplain that they regulate (i.e. the floodway fringe). Carmel and Westfield currently do not have regulations that prohibit fill in the floodway fringe. This issue is discussed in more detail in Chapter 4.

A more detailed discussion of some of the problems identified from the Flood Insurance Rate Maps is included in Chapter 3.

2.2.5 Zoning Maps

Zoning maps were used to assist in identifying existing and future land use (an important variable in hydrologic analysis). Carmel has an official zoning map produced by the City of Carmel GIS for the City's Department of Community Services. The map was last modified in March 2002. Westfield also has an official zoning map (January 1997). Both the Carmel and Westfield maps list several different categories of residential, commercial, business, and other districts.

2.2.6 Aerial Photography Maps

In addition to the aerial photography maps provided with the Hamilton County GIS, paper maps of aerial photographs (spring 1997) from the State Land Office were also obtained and used on the project. While these maps are somewhat out of date in developing areas, and their resolution is not as good as the County's GIS maps, they do provide a more convenient viewable scale. The State Land Office maps are at a scale of 1" = 400' and 15 maps provide complete coverage of the watershed.

2.3 PREVIOUS REPORTS AND STUDIES

Several previous reports and studies were used in this study. The following is a summary of these documents.

2.3.1 IDNR Department Memorandum on Grassy Branch Re-Study, July 12, 2001

Grassy Branch is a tributary to Cool Creek that begins near 186th Street and flows south then east under US 31, through Westfield, and discharges into Cool Creek just south of SR 32. The entire stream is named "Grassy Branch" on USGS Quadrangle Map (Westfield). On the FEMA floodplain maps, the stream is called "Evan Kindall Drain." Locally, the stream is known as the *Anna Kendall* Drain (note difference in drain name and spelling). For this report, the stream will be referred to as the Anna Kendall Drain.

The purpose of this IDNR Department Memo was to summarize changes to the hydraulic model of the Anna Kendall Drain. The memo states that the model was updated between 1998 and September 2000 by a Christopher B. Burke Engineering, LTD (CBBEL). The model was revised to reflect changes in the upstream portion of the stream. A portion of the channel downstream from SR 32 and Oak Ridge Road was reconstructed, and an abandoned railroad crossing was removed. A complete restudy of the drain upstream of US 31 was also completed. The restudy was prompted because of a dredging project that occurred in 1998, upstream of SR 32 that resulted in the channel bottom being lowered approximately 4 feet. IDNR made some changes to the CBBEL models. These changes included minor revisions in flows, starting water surface elevations, and channel roughness coefficients. The final IDNR model was used in analyses performed in this study. The results of the Grassy Branch Re-Study were also incorporated into the February 2003 updated FIRMs.

2.3.2 Hydraulic Report for Village Farms Wilfong, July 10, 1996

This report, prepared by Weihe Engineers, Inc., analyzed the performance of a lake and dam at the Village Farms subdivision. The lake is the upstream-most of a series of two lakes that drain a tributary of the Osborn & Collins #2 Drain in unincorporated Hamilton County, west of Oak Ridge Road and north of 146th Street. This lake, which was designed as a Class 'B' dam structure in 1980, provides runoff control for approximately one square mile. The lake was originally 12.7 acres, but was increased by 3.44 acres, for a total surface area of 16.14 acres. The software used to perform the analysis is not identified in the report though it is clear that SCS methodology was used. The report indicates that the 100-year flow would be reduced from 1000 cfs to 87 cfs. This basin was analyzed independently of the hydrologic model in this study. The results of our hydrologic analysis are quite different than those reported in the Village Farms Wilfong report (see Chapter 5, Section 5.5.2).

2.3.3 Countryside Overall System Drainage Report, August 1, 2001

This report, prepared by Stoeppelwerth and Associates, analyzed the detention basin system provided for the Countryside residential subdivision in Washington Township in unincorporated Hamilton County. The subdivision is located in west of Oak Ridge Road and north of 161st Street and drains into the H. G. Kenyon Drain. The total site consists of 483 acres, though only the eastern portion of the development is in the Cool Creek watershed. The ponds were designed according to current Hamilton County stormwater standards.

2.3.4 Soil Survey of Hamilton County, Indiana, U. S. Department of Agriculture Soil Conservation Service, November 1978

The Soil Survey of Hamilton County was used, in conjunction with aerial photographs and zoning maps, to determine runoff Curve Numbers (CNs) for the hydrologic analysis. These soils designations are also provided on the County's GIS. Along the Cool Creek soils are mostly classified as Shoals-Genesee (Sh, Ge). The Shoals series of soils consists of deep, somewhat poorly drained, moderately permeable soils on floodplains. The Genesee series are adjacent to Shoals and consist of deep, well drained, moderately permeable soils on floodplains.

The upper portion of the watershed consists of Crosby and Brookston (Cr, Br) soils (about 50/50 distribution). The Crosby series consists of deep, somewhat poorly drained, slowly permeable soils on glacial till plains. The Brookston series consists of deep, very poorly drained, moderately permeable soils on glacial till plains and are generally near Crosby soils. Crosby soils are better drained and are in a higher position than Brookston soils. The lower portion of the watershed, closer to the White River, has more Miami series soils (Mm). The Miami series consists of deep, well drained soils on till plains and have loose sand and gravelly sand in the underlying material.

Soil types are used to help determine runoff CNs through the identification of hydrologic soil groups. Soils are classified into four groups – A, B, C, or D, depending on their minimum infiltration rate. The groups are summarized below (Source: TR-55, Urban Hydrology for Small Watersheds, SCS, June 1986).

Group A	Low runoff potential and high infiltration rates even when thoroughly wetted. Consist of deep, well to excessively drained sands or gravels. Infiltration rate greater than 0.30 in/hr. Low runoff potential.
Group B	Moderate infiltration rates when thoroughly wetted. Consist of moderately deep to deep, moderately well to well drained soils. Infiltration rate of 0.15 to 0.30 in/hr. Low/Medium runoff potential.
Group C	Low infiltration rates when thoroughly wetted. Soils impede downward movement of water. Infiltration rate of 0.05 to 0.15 in/hr. Medium/High runoff potential.
Group D	Soils have high runoff potential and very low infiltration rates. Clay soils with high swelling potential and a permanent high water table. Infiltration rate of 0.00 to 0.05 in/hr. High runoff potential.

In the Cool Creek watershed, the Genesee and Miami soils are Group B, while the Crosby and Shoal soils are Group C. Brookston soils are listed as B/D with B for locations that are drained and D for areas that are undrained. Conversations with Hamilton County Soil and Water Conservation District indicate that these soils often respond like Group D soils due to soil compaction that often accompanies development.

2.3.5 Flood Insurance Studies

Flood Insurance Studies (FIS) for Carmel, Westfield, and Hamilton County were obtained and reviewed. As mentioned previously, these studies were updated during the course of this project; however, resulting flood flows and stages are generally consistent with the previous studies. The FIS reports list peak discharges and corresponding flood profiles for 10-, 50-, 100-, and 500-year recurrence interval storm events.

A summary of 100-year peak discharges for Cool Creek and its tributaries is provided in Table 2-1. Peak flows for Cool Creek range from 6000 cfs at the mouth to 1200 cfs at 186th Street. The hydrologic modeling completed for this project resulted in flows that were generally within 20 percent of those published in the FIS.

Table 2-1
Flood Insurance Study – 100-year Flow Summary

Location	Drainage Area (sq. mi.)	100-year peak flow (cfs)
Cool Creek		
At mouth	23.7	6000
Below Hot Lick Creek	20.5	5400
Below Highway Run	15.8	4300
At 146th Street	13.8	3720
Below Anna Kendall Drain	7.2	2420
Above Anna Kendall Drain	3.9	1550
At East 186th Street	2.8	1200
Hot Lick Creek		
At mouth	0.4	540
Anna Kendall Drain		
At mouth	3.3	2400
Above Bowman Drain	2.3	1050
At US 31	2.0	940

2.4 OTHER INFORMATION FROM REGULATORY AGENCIES

Other information obtained from regulatory agencies included:

- Hydrologic/Hydraulic Models
- IDNR Permits
- IDEM Rule 5 and 6 Permits
- INDOT Information on US 31

2.4.1 Hydrologic/Hydraulic Models

Existing hydrologic/hydraulic models were obtained from IDNR. The models included:

- HEC-1 model of the Cool Creek Watershed
- HEC-2 model of Cool Creek (to 186th Street)
- HEC-2 model of Upper Cool Creek (upstream from 186th Street)
- HEC-2 model of Little Cool Creek
- E-431 (hydraulic) models of Hot Lick Creek and Grassy Branch (Anna Kendall Drain)
- HEC-RAS model of the upper portion of Grassy Branch (Anna Kendall Drain)

The HEC-1 model (software developed by U. S. Army Corps of Engineers) is a hydrologic model that simulates the rainfall runoff process and generates hydrographs for various storm events. The HEC-1 model of the Cool Creek was used by IDNR to assist in developing Coordinating Discharges for the stream. The IDNR model is more generalized than the detailed hydrologic model developed for this project.

The HEC-2 models (software developed by U. S. Army Corps of Engineers) simulate stream hydraulics and predict peak flood stages for various storm events. The IDNR models were converted to HEC-RAS (a newer release of HEC-2 with a graphical user interface) and were used to analyze problems and develop solutions in the Cool Creek watershed. The E-431 models are older hydraulic models that are no longer supported by the model developer (U. S. Geological Survey).

2.4.2 IDNR Permits

IDNR regulates construction activity or land alteration in mapped floodways and also issues any changes to floodway maps (called Letter of Map Amendments or Revisions). Information on floodway permits can be found at IDNR's web site:

http://www.state.in.us/dnr/water/permits/index.html.

Permits issued in the Cool Creek watershed total 102 (82 on Cool Creek; 6 on Little Cool Creek; and 14 on Grassy Branch/Anna Kendall Drain). The approximate distribution by permit type is as follows:

44%	Utility related (storm outfalls, water main crossings, etc.)
24%	Stream crossings (bridge replacements, new bridges/culverts, bridge repair, etc.)
11%	Fill activities (tennis courts, parking lots, etc.)
10%	Miscellaneous grading and excavation
6%	Excavation for ponds
5%	Streambank stabilization

A summary listing of the IDNR permits is provided in Appendix A.

2.4.3 IDEM Rule 5 and Rule 6 Enforcement

IDEM regulates stormwater runoff from construction sites and certain industrial activities. Rule 5 is a general permit that requires erosion and sediment controls for all construction sites that disturb more than five acres. This threshold recently dropped to sites disturbing more than one acre. Rule 6 governs stormwater runoff from certain industrial sites (ones that are more likely to cause stormwater runoff pollution).

The IDEM database was reviewed to determine if there were any enforcement actions regarding Rule 5 and Rule 6 (and other regulations) in the Cool Creek watershed. Information on IDEM enforcement is found at http://www.in.gov/serv/idem/oe. Two "Notice of Violations" were issued in the watershed. One in 1997 for a residential subdivision development that failed to submit a Notice of Intent (NOI) to comply with Rule 5 and one in 2001 for a commercial development that failed to submit an NOI, did not have its erosion and sediment control plan approved prior to construction, and had erosion control measures that were not properly installed and maintained. Both of these cases appear to have been resolved without Agreed Orders or civil penalties. No Rule 6 violations were found.

A water quality violation (unrelated to Rule 5 or Rule 6) occurred in April of 1999 for a private water utility (Hamilton Western Utilities, Inc.) that was found to be discharging water treatment plant backwash into a tributary of Cool Creek. This water treatment plant, located at 1140 Greyhound Pass, is no longer used since the new River Road water plant was put on line. The violation was settled with an Agreed Order and an assessed civil penalty of $4,250.

2.4.4 INDOT Information on US 31

The Indiana Department of Transportation (INDOT) is currently undertaking a study on improvements to US 31 between I-465 and SR 38 (12.5 miles). Information on the project can be found at http://www.us31indiana.com/. The purpose of this project is to reduce congestion for the US 31 corridor; improve the level of safety for motorists; and provide for reliable and efficient movement of commerce and regional travel. This project will essentially upgrade US 31 to Interstate standards by removing all at-grade intersections and uncontrolled access points.

A "US 31 Preliminary Alternatives Analysis and Screen Report" (Parsons Transportation Group, July 2002) narrows upgrade options down to two alternatives shown as Alts F and G in the Figure 2-4. Alt F generally follows the existing US 31 corridor while Alt G swings to the east of Westfield north of 161st Street. A Draft Environmental Impact Statement is expected to be released in 2003 for public comment.

Alts F and G would disturb 4 and 9 acres of wetlands and 38 and 54 acres of floodplains, respectively. Alt F would have 12 stream crossings involving 5170 feet of stream and Alt G would have 11 crossings involving 4715 feet of stream. As this project moves forward, impacts to water quality and quantity should be carefully evaluated and mitigated as needed.

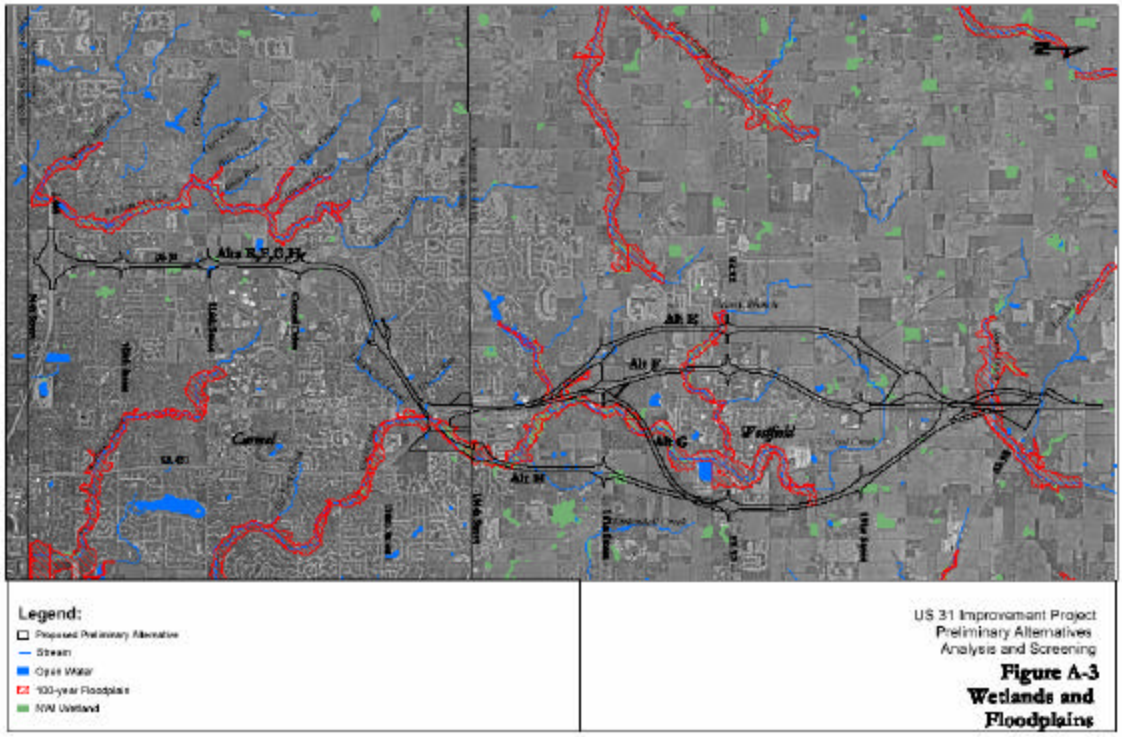

Figure 2-4
Excerpt from US 31 Improvement Report

2.5 ORDINANCES AND STANDARDS

Hamilton County, Westfield, and Carmel ordinances and site design standards were reviewed as they pertain to stormwater management. Carmel and Westfield both follow the Hamilton County standards, which is a key advantage in terms of providing consistent stormwater management controls in the different jurisdictions in the watershed.

Local site design standards require developers to provide detention facilities (ponds) that temporarily restrict increased stormwater runoff resulting from new impervious surfaces (e.g. roadways, sidewalks, rooftops) that are constructed in new developments. Ponds must be designed to limit stormwater discharge for both large and small storms. Developers are currently required to construct detention ponds that collect water from their respective developments and restrict the peak discharge to a magnitude below the pre-development condition. Chapter 5 – Hydrologic Analysis includes an evaluation of the effectiveness of current detention requirements on peak flow control.

Many ponds in new developments have a permanent pool of water that remains after a storm event. These ponds (often referred to as wet ponds) provide some water quality benefit. However, design standards for these types of ponds need to be upgraded to provide better water quality enhancement performance and protect downstream channels.

Hamilton County also has an ordinance that prohibits fill in the floodplain of any drainageway. This is a proactive requirement in that it preserves natural flood storage and also protects water quality. Carmel and Westfield (and many other communities in Hamilton County) allow development within the floodplain, provided that it meets certain standards to prevent flooding.